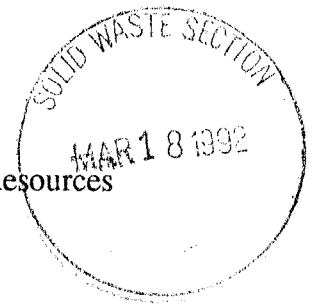
Duke University
DURHAM, NORTH CAROLINA
27706

FACILITIES PLANNING & MANAGEMENT
MANAGER, UTILITIES

211 FACILITIES CENTER
TELEPHONE (919) 660-4225
FAX (919) 684-6083

March 16, 1992



Mr. Jim Coffey
State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687
Raleigh, NC 27611-7687

Re: **Furnace Ash Utilization**
Structural Fill
Duke University Construction Projects

Dear Mr. Coffey:

Approval is hereby sought to utilize furnace ash from coal combustion at Duke University's Steam Plant for structural fill in the foundation of the Science Research Center (SRC) under construction on the West Campus of Duke University in Durham, North Carolina. A comprehensive set of TCLP chemical tests was made on a representative sample of furnace ash from Duke University's plant on January 13, 1992. The results were given to you by letter dated February 24, 1992. For completeness, the results of these tests are enclosed and meet the requirements of North Carolina regulations for Class GA Waters (potable water supplies).

Furnace ash will be stockpiled on the construction site for SRC and used for structural fill as the need occurs and construction progresses. Four to five thousand tons of furnace ash are estimated as needed for structural fill. The amount of furnace ash stockpiled on site will not exceed this quantity at any time.

As part of the approval for the use of furnace ash as structural fill for the SRC construction, Duke agrees to the following special conditions:

- approval is subject to the nature and approximate volume of furnace ash presented above,

- stockpiled furnace ash on site will be maintained in a condition to obviate any wind or water erosion in excess of what would normally occur for any structural fill stockpiled on site,

- furnace ash will be used and placed in accordance with structural fill specifications for the SRC project,

- the approval is not transferable,

- if the stockpiling and use of furnace ash becomes unsatisfactory, including the creation of nuisance conditions, correction measures will be taken or the use of furnace ash will cease,

- all structural fill at the site will be placed and utilized in a non-discharge system with no discharge of waste water from the foundation,

- adequate records of the use of the furnace ash will be maintained by the geotechnical consultant providing testing services for SRC construction. The records will include but are not necessarily limited to the following:

  - ash placement,

  - method of application,

  - volume of ash applied, and

  - location of use,

- the following criteria is met by the SRC project:

  - no water wells within 100 feet,

  - structural fill is greater than 1 foot above mean seasonal high water table,

  - no stream, creek, lake pond or other surface water body exists in the general area, and

  - the construction is surrounded by Duke University property.

Your prompt attention to this request will be greatly appreciated. Within the next couple of weeks, a need will occur for structural fill that could be met by the furnace ash. If there are any questions, please call Dr. Wendell Parker with GAI Consultants at 783-4783.

Sincerely,

C. Ronald Gilchrist

C. Ronald Gilchrist
Utilities Manager

CRG/wl

cc: Wendell Parker
Terry Dover
FILE

Enclosure as Stated

GAI CONSULTANTS

GAI Consultants-NC, Inc.

4000 Blue Ridge Road
Suite 500
Raleigh, NC 27612
919/783-4783
FAX 919/783-0241

February 24, 1992

Mr. C. Ronald Gilchrist
Manager, Utilities - Facilities Operations
Facilities Planning and Management
Duke University
Durham, North Carolina 27706

Re: Ash Test Results
Duke University Ash
Project No. 92105.02

Dear Mr. Gilchrist:

Enclosed are the revised results of the comprehensive set of TCLP chemical tests made on the sample of ash obtained from Duke University's Plant on January 13, 1992. The ash was retested and results reported for lead and arsenic to the detection limit required for drinking water standards for these two metals. The test results meet potable water supply standards.

The moisture-density relationship for compaction of the ash was determined in the laboratory using ASTM Test Procedure D 698, Method A (standard Proctor). The relationship shows a maximum dry density of 51 pcf at an optimum moisture content of 43.5%

We look forward to delineating projects to use the ash as structure fill in the near future.

Sincerely,
GAI Consultants-NC, Inc.

Wendell W. Parker, Ph.D., P. E.
Engineering Manager

Enclosed: As stated

cc: Mr. James C. Coffey

WWP:dsm

:92105-02.L02

FACILITIES PLANNING & MANAGEMENT
92 FEB 26 PM 3:28

CTE **Chemical & Environmental Technology, Inc.**

ENVIRONMENTAL LABORATORY AND CONSULTING SERVICES

JOHN M. OGLE
PRESIDENT

P. O. BOX 12298
RESEARCH TRIANGLE PARK, N. C. 27709
PHONE (919) 467-3090
FAX (919) 467-3515

February 3, 1992

MR. WENDELL PARKER
GAI CONSULTANTS OF NC, INC.
4000 BLUE RIDGE RD.
SUITE 500
RALEIGH, NC 27612

REVISED: FEB. 17, 1992

RE: FLY ASH STABILITY
92105.02

SAMPLE HISTORY

CLIENT ID	CET SAMPLE	DATE SAMPLED	DATE RECEIVED
FURNACE	55791	1-13-92	1-13-92

CHEMICAL & ENVIRONMENTAL TECHNOLOGY, INC

Terrie H. Litzenberger

TERRIE H. LITZENBERGER
LABORATORY DIRECTOR

2-03-92RE

FEB 1992 RECEIVED GAI, INC. CONSULTING ENGINEERS

GAI CONSULTANTS OF NC, INC.
FLY ASH STABILITY # 92105.02
55791
FEBRUARY 3, 1992

TOXIC CHARACTERISTIC LEACHATE PROCEDURE
METHOD 1311
METALS

CLIENT ID: FURNACE
EXTRACTION DATE: 1-16-92
DIGESTION DATE: 1-20-92

PARAMETER	METHOD	DETECTION LIMIT	DATE ANALYZED	RESULT	UNITS
ARSENIC	7060	0.005	2-14-92	BDL	MG/L
BARIUM	6010	0.005	1-21-92	0.731	MG/L
CADMIUM	6010	0.005	1-21-92	BDL	MG/L
CHROMIUM	6010	0.01	1-21-92	BDL	MG/L
LEAD	7421	0.002	2-11-92	0.024	MG/L
MERCURY	7470	0.0002	1-21-92	BDL	MG/L
SELENIUM	7740	0.002	1-27-92	BDL	MG/L
SILVER	6010	0.005	1-21-92	BDL	MG/L

BDL = BELOW DETECTION LIMIT.

"TEST METHODS FOR EVALUATING SOLID WASTES", SW-846, VOLUME 3, SEPTEMBER, 1986

REPORTED BY: _____
JOHN MCGINTY

2-03-92RE

GAI CONSULTANTS OF NC, INC.
FLY ASH STABILITY # 92105.02
55791
FEBRUARY 3, 1992

TOXIC CHARACTERISTIC LEACHATE PROCEDURE (1311)
VOLATILE ORGANICS
METHOD 8021
DATE ANALYZED: 1-21-92
CLIENT ID: FURNACE
DATE EXTRACTED: 1-20-92
CET SAMPLE: 55791

PARAMETER	DETECTION LIMIT (ug/L)	RESULTS (ug/L)
BENZENE	5.0	BDL
CARBON TETRACHLORIDE	5.0	BDL
CHLOROBENZENE	5.0	BDL
CHLOROFORM	5.0	BDL
1,4-DICHLOROBENZENE	5.0	BDL
1,2-DICHLOROETHANE	5.0	BDL
1,1-DICHLOROETHENE	5.0	BDL
TETRACHLOROETHENE	5.0	BDL
TRICHLOROETHENE	5.0	BDL
VINYL CHLORIDE	10.0	BDL
METHYL ETHYL KETONE	10.0	BDL

INTERNAL STANDARD RECOVERY	
FLUOROBENZENE	112%
1-CHLORO,2-BROMO PROPANE	112%

BDL = BELOW DETECTION LIMIT.

"TEST METHODS FOR EVALUATING SOLID WASTES", SW-846, VOLUME 3, SEPTEMBER, 1986

J - Indicates an estimated value. This flag is used when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit.

REPORTED BY: A. Link Thrower
LINK THROWER

2-03-92RE

GAI CONSULTANTS OF NC, INC.
FLY ASH STABILITY # 92105.02
55791
FEBRUARY 3, 1992

TOXIC CHARACTERISTIC LEACHATE PROCEDURE (1311)
PESTICIDES
METHOD 8080
DATE ANALYZED: 1-28-92
CLIENT ID: FURNACE
CET SAMPLE: 55791
DATE EXTRACTED: 1-22-92

PARAMETER	DETECTION LIMIT (ug/L)	RESULTS (ug/L)
CHLORDANE	1.0	BDL
ENDRIN	1.0	BDL
HEPTACHLOR	1.0	BDL
HEPTACLOR EPOXIDE	1.0.	BDL
LINDANE	1.0	BDL
METHOXYCHLOR	1.0	BDL
TOXAPHENE	1.0	BDL

BDL = BELOW DETECTION LIMIT.

"TEST METHODS FOR EVALUATING SOLID WASTES", SW-846, VOLUME 3, SEPTEMBER, 1986

J - indicates an estimated value. This flag is used when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit.

REPORTED BY: A. Link Thrower
LINK THROWER

2-03-92RE

GAI CONSULTANTS OF NC, INC.
FLY ASH STABILITY # 92105.02
55791
FEBRUARY 3, 1992

TOXIC CHARACTERISTIC LEACHATE PROCEDURE (1311)
HERBICIDES
METHOD 8150
DATE ANALYZED: 1-28-92
CLIENT ID: FURNACE
CET SAMPLE: 55791
DATE EXTRACTED: 1-23-92

PARAMETER	DETECTION LIMIT (ug/L)	RESULTS (ug/L)
2,4-D	1.0	BDL
SILVEX	1.0	BDL

BDL = BELOW DETECTION LIMIT.

"TEST METHODS FOR EVALUATING SOLID WASTES", SW-846, VOLUME 3, SEPTEMBER, 1986

J - Indicates an estimated value. This flag is used when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit.

REPORTED BY: A. Link Thrower
LINK THROWER

2-03-92RE

GAI CONSULTANTS OF NC, INC.
FLY ASH STABILITY # 92105.02
55791
FEBRUARY 3, 1992

TOXIC CHARACTERISTIC LEACHATE PROCEDURE (1311)
SEMI-VOLATILE ORGANICS
METHOD 8270
DATE ANALYZED: 1-30-92
CLIENT ID: FURNACE
DATE EXTRACTED: 1-22-92
CET SAMPLE: 55791

PARAMETER	DETECTION LIMIT (ug/L)	RESULTS (ug/L)
o-CRESOL	10	BDL
m-CRESOL	10	BDL
p-CRESOL	10	BDL
CRESOL	10	BDL
2,4-DINITROTOLUENE	10	BDL
HEXACHLOROBENZENE	10	BDL
HEXACHLOROBUTADIENE	10	BDL
HEXACHLOROETHANE	10	BDL
NITROBENZENE	10	BDL
PENTACHLOROPHENOL	50	BDL
PYRIDINE	10	BDL
2,4,5-TRICHLOROPHENOL	10	BDL
2,4,6-TRICHLOROPHENOL	10	BDL

BDL = BELOW DETECTION LIMIT.

"TEST METHODS FOR EVALUATING SOLID WASTES", SW-846, VOLUME 3, SEPTEMBER, 1986

J - Indicates an estimated value. This flag is used when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit.

REPORTED BY: A. Link Thrower
LINK THROWER

2-03-92RE

GAI CONSULTANTS, INC.
Chain of Custody Record

Proj. No.	Project Name						No. of containers	Complete TCLP						Remarks
92105.02	FLY ASH STABILITY													
Samplers: (Signature)														
Sta. No.	Date	Time	Comp.	Grab	Station Location									
55791 FURNACE	1-13-92	3:50		X	POWER HOUSE		1	X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	1-13 4:30				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	
		[signature]	1-13-92 4:30		

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

May 27, 1992

Mr. C. Ronald Gilchrist
Utilities Manager
Duke University
211 Facilities Center
Durham, North Carolina 27706

RE: Beneficial Re-use of Duke University Coal Ash

Dear Mr. Gilchrist:

The Solid Waste Section considers the re-use of ash as an ingredient in the manufacturing of cement as beneficial re-use as long as the material is non-hazardous.

Pincelli and Associates, Inc. has contacted the Section requesting our approval to utilize ash in cement manufacturing. The Section issued such approval on March 31, 1992. Enclosed please find a copy of our correspondence.

If you have any questions or comments, please contact our office at (919)733-0692.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Suzanne Molloy
Terry Dover
Mark Fry

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

March 31, 1992

Ms. Elise P. Johnson
Pincelli & Associates, Inc.
P. O. Box 1055
Hixon, Tennessee 37343

RE: Beneficial Re-use of Coal Ash in Cement Manufacturing

Dear Ms. Elise:

The Solid Waste Section has reviewed your request to utilize coal ash as an ingredient in the manufacturing of cement. At this time, such specified re-use is approved by the Solid Waste Section.

Any upcoming revisions to the North Carolina Solid Waste Management Rules or Policy which would modify this continuing approval may require modifications where necessary.

This approval does not exempt your company from meeting the storage and transportation requirements of solid waste in accordance with Sections .0104 and .0105 of the Solid Waste Management Rules. Enclosed please find a copy of the Rules.

If you have any questions of comments, please contact our office at (919)733-0692.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

ENCLOSURE

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

April 6, 1992

Mr. C. Ronald Gilchrist
Utilities Manager
Duke University
211 Facilities Center
Durham, North Carolina 27706

RE: Furnace Ash Utilization
Structural Fill
Science Research Center, Duke University, West Campus

Dear Mr. Gilchrist:

The Solid Waste Section has reviewed the referenced project for the use of furnace ash as structural fill. Based upon the information received, the project is approved with the following conditions:

1) The transportation requirements outlined in Section .0105 of the Solid Waste Management Rules shall be met. To prevent dusting, ash shall be transported in tarped trucks.

2) To prevent dusting on site, all stockpiled furnace ash shall be conditioned to an appropriate percent moisture, when necessary.

3) All furnace ash structural fill shall be capped with a minimum of 6 inches of earthen material, unless capped by paving, building foundation, or other structure.

4) Approval may be rescinded if the reuse program is carried out in a manner which does not protect the assigned water quality and groundwater quality standards.

Even though a specific solid waste permit is not required, this approach by the Section does not exempt this activity from other local, state, or federal regulations including, but not limited to,

zoning restrictions, floodplain regulations, wetland restrictions, and/or sediment & erosion control regulations.

If you have any questions, please contact our office at (919)733-0692.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Suzanne Molloy✓
Terry Dover
Mark Fry
Wyndell Parker

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

May 27, 1992

Mr. C. Ronald Gilchrist
Utilities Manager
Duke University
211 Facilities Center
Durham, North Carolina 27706

RE: Furnace Ash Utilization
Structural Fill
Law School Addition, Public Policy Building, Medical Science Research Building, Utilitiy Trenches, Duke University

Dear Mr. Gilchrist:

The Solid Waste Section has reviewed the referenced project for the use of furnace ash as structural fill. Based upon the information received, the project is approved with the following conditions:

1) The transportation and storage requirements outlined in Sections .0104 and .0105 of the Solid Waste Management Rules shall be met. To prevent dusting, ash shall be transported in tarped trucks.

2) To prevent dusting on site, all stockpiled furnace ash shall be conditioned to an appropriate percent moisture, when necessary.

3) All furnace ash structural fill shall be capped with a minimum of 6 inches of earthen material, unless capped by paving, building foundation, or other structure.

4) Quality control measures shall be implemented to assure that only ash having similar characteristics as that represented in the report be utilized.

5) Approval may be rescinded if the reuse program is carried out in a manner which does not protect the assigned water quality and groundwater quality standards.

Even though a specific solid waste permit is not required, this approach does not exempt this activity from other local,

state, or federal regulations including, but not limited to, zoning restrictions, floodplain regulations, wetland restriction, and/or sediment and erosion control regulations.

If you have any questions, please contact our office at (919)733-0692.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Suzanne Molloy
Terry Dover
Mark Fry